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1) Seed yield efficiency in soybeans.

Soybean (Glycine max (L.) Merrill) cultivars with high seed yield efficiency (SYE) can be used in breeding programs to increase yield. An efficient cultivar can be characterized either by a high ratio of seed to nonseed dry weight (above ground unthreshed air-dry weight of plant at maturity minus seed weight) or by a steep regression slope of seed over nonseed dry weight. High SYE indicates that a high proportion of total plant dry weight is seed weight (Veatch, 1930). Dry bean (Phaseolus vulgaris) cultivars studied by Wallace and Munger (1966) differed distinctly in their harvest indices (HI = economic yield divided by total plant dry weight x 100). Efficient plants utilize more energy for production of seed and less for nonseed plant parts. Schutz and Brim (1967), utilizing regression coefficient analysis of SYE values, found that certain varieties became more efficient in competitive situations than in pure stands.

The present investigation was undertaken to determine the extent of variability of SYE in ten selected soybean varieties.

Materials and methods: The experiment was conducted during 1971 at the Agronomy Farm of The Ohio State University, Columbus, Ohio. Ten soybean varieties, belonging to maturity groups I, II, III, and IV, were selected on the basis of their diversity in maturity, plant height, and growth habit. Most of the seeds were supplied by the Regional Soybean Laboratory, Urbana, Illinois. The seedlings grown in the greenhouse were randomly arranged in the field and spaced 91 cm apart in 71 cm rows. The number of single plant replications were: 'Aoda,' 12; 'Cayuga,' 9; 'Giant Green,' 8; 'Habaro,' 20; 'Hakote,' 9; 'Henry,' 46; 'Kent,' 39; 'Kura,' 13; 'Manchuria,' 7; and 'Wayne,'

45. Each plant was harvested at maturity at ground level, bagged separately in a cloth bag, and analyzed separately. Chow's test (1960) was used to test the significant difference between regression coefficients of different cultivars. The unthreshed weight of the plant included the air-dry weight of main stem, branches, pods and all seeds; and nonseed dry weight was calculated by subtracting seed yield from this weight. Seed yield to nonseed dry weight ratio or seed yield efficiency (SYE) was calculated by dividing seed yield by nonseed dry weight of the plant.

Results and discussion: Results showed a marked variation in SYE as expressed by ratio of seed yield to nonseed dry weight among the cultivars within each maturity group and between different maturity groups (Table 1). Wayne was the most efficient cultivar with SYE of 1.52. Cayuga ranked second with SYE of 1.51 and Manchuria was a close third at 1.49. Aoda and Giant Green were least efficient and SYE for these varieties was 1.28. This suggests that of the total energy required in producing a Wayne plant, more is utilized in production of seed, while Aoda and Giant Green utilize a larger proportion of their energy in production of nonseed dry weight and consequently produce less seed. The mean yield, nonseed dry weight and SYE (Table 1) for Kent indicated that it was the highest yielding but with mediocre SYE of 1.42. In contrast, Cayuga produced only 14.1 g seed and 9.3 g nonseed dry weight but the mean SYE was very high (1.51). These data suggest that the high yielding cultivars under cultivation today may not be the most efficient varieties from the point of view of water and energy utilization.

The statistical analysis of regression coefficients of seed yield with nonseed dry weight, which was another measure of efficiency, also revealed that considerable variability existed among the ten cultivars. Hakote ($Y = 2.503 - 13.413$) was the most efficient cultivar in producing seed yield per unit of nonseed dry weight, and Henry ($Y = 1.113X + 4.229$) was the least efficient but these two varieties were not the most and least efficient respectively as indicated by the ratio (SYE) of seed to nonseed dry weight. Perfect agreement of these two tests should not be expected because mathematically different parameters were being measured by the use of ratios and regression coefficients.

SYE is important to both farmers and researchers in its effect on water and fertilizer usage.

Table 1
Mean values per plant for different traits in 10 soybean cultivars

Cultivar	Nonseed dry wt. (g)	Seed yield (g)	SYE (ratio)	Slope	Intercept
Cayuga	9.3	14.1	1.51	1.629	- 1.022
Giant Green	9.8	13.0	1.28	2.158	- 8.214
Habaro	13.1	19.7	1.44	1.682	- 2.436
Manchuria	9.1	14.8	1.49	1.960	- 2.978
Hakote	12.8	19.0	1.44	2.503	-13.413
Henry	21.4	28.0	1.32	1.113	4.229
Kura	18.4	24.7	1.35	1.125	3.935
Wayne	30.8	47.6	1.52	1.626	- 3.075
Aoda	20.6	27.2	1.28	1.455	- 2.840
Kent	40.2	59.0	1.42	1.626	- 6.314

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